ONSITE INSPECTION EXPERIENCE OF ELECTRIC EQUIPMENT IN LICENSE PROCESS OF THE CONTINUED OPERATION OF KORI UNIT ONE

-Site Inspection during review stage and refurbishment work-

O.P.ZHU, B.R.KIM, S.H.OH, N.S.JIN
zhu@kins.re.kr

Korea Institute of Nuclear Safety (KINS), Deajeon city, Korea

Second International Symposium on Nuclear Power Plant Life Management
15-18 October 2007, Shanghai, China

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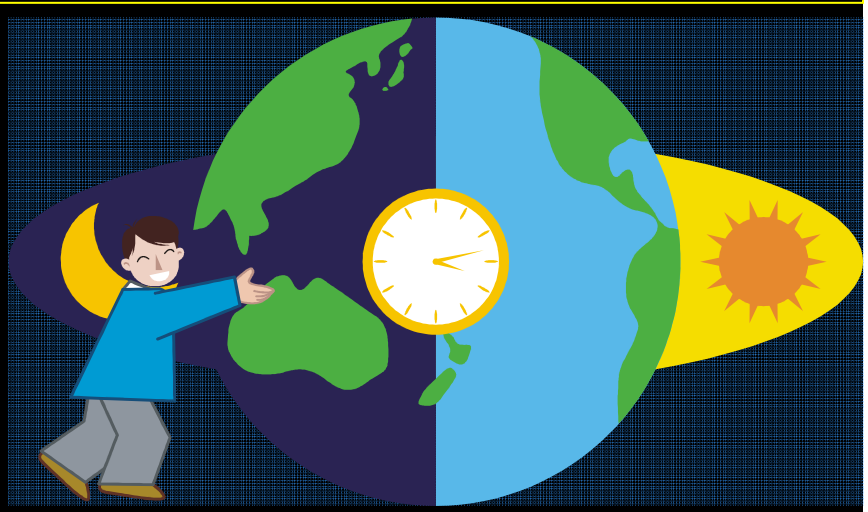
- Introduction: framework, requirements
- Environmental Qualification: Monitoring, EQ methods
- Time Limited Aging Analysis and EQ
- Interim Results of COI

1. Introduction

- Chronicle of Kori unit one
  - 1972 license for construction & operation
  - 1977 first criticality
  - 1988 first commercial operation
- Design life : 30 years
- Operating performance: Capacity Factor 92% for 5 years
- Original EQ documents are not fully meet Requirements
  - Turnkey based Project or early 70's standards for EQ



1. Introduction(1)

- Scoping and Screening the equipments for review
  - Criteria : 10CFR 54.4, 10CFR 54.21
- Replacement of equipments as follows
  - Anticipated Transient Without Scram mitigation system
  - Process control protection and monitoring instruments improvement
  - 4.16 kV switch gears, 125V Class 1E Battery banks
  - AAC diesel generator in Kori site.
  - Main and auxiliary transformers
  - Main generator and excitation system
  - Generator Circuit Breaker

1. Introduction(2-1): Legal Framework

- For continued operation beyond its design life time
  - Submission of PSR report
    - Korean Enforcement Decree of the Atomic Energy Act
    - Notice of the MOST: Aging management program included.
  - Aging management program
    - Scoping and screening results of aging management TLAA including the continued operation term
    - Operation experience feedback and important safety research results

1. Introduction(2-2): Framework for Inspection

- Periodic safety inspection (PSI)
  - By Notice of the MOST No.2005-10
  - Whether Existing licensing bases are met properly.
  - Well established inspection experience for 30 years
- Continued operation inspection (COI)
  - By Notice of the MOST No.2005-31
  - Whether measures and the implementation activities of the licensee are appropriate in view of newly upgraded standards ; 'CLB'
  - New, review-oriented and dependent on inspectors' expertise
  - Parallel with safety review for continued operation including PSR

1. Introduction(3,4,5):AMP/TLAA/Experience

- 39 AMPs (MOST Notice 2005-31)
  1. 6 items: Electrical Cables and Connections (3), Metal Enclosed Bus, Fuse Holders, Electrical Cable Connections
  2. Others(33: not related Electrical Equipment)
- Three type of TLAA
  - I. The analyses remains valid for the period of continued operation
  - II. -- have been projected to the end of the continued operation : Temperature monitoring data of plant equipment / cable will be used for life extension
  - III. The effects of aging on the intended functions will be adequately managed for the period: Ongoing Qualification
- Operating Experience
  - Items important from operational experiences and safety research results

2. Environmental Qualification(1): Req'mts

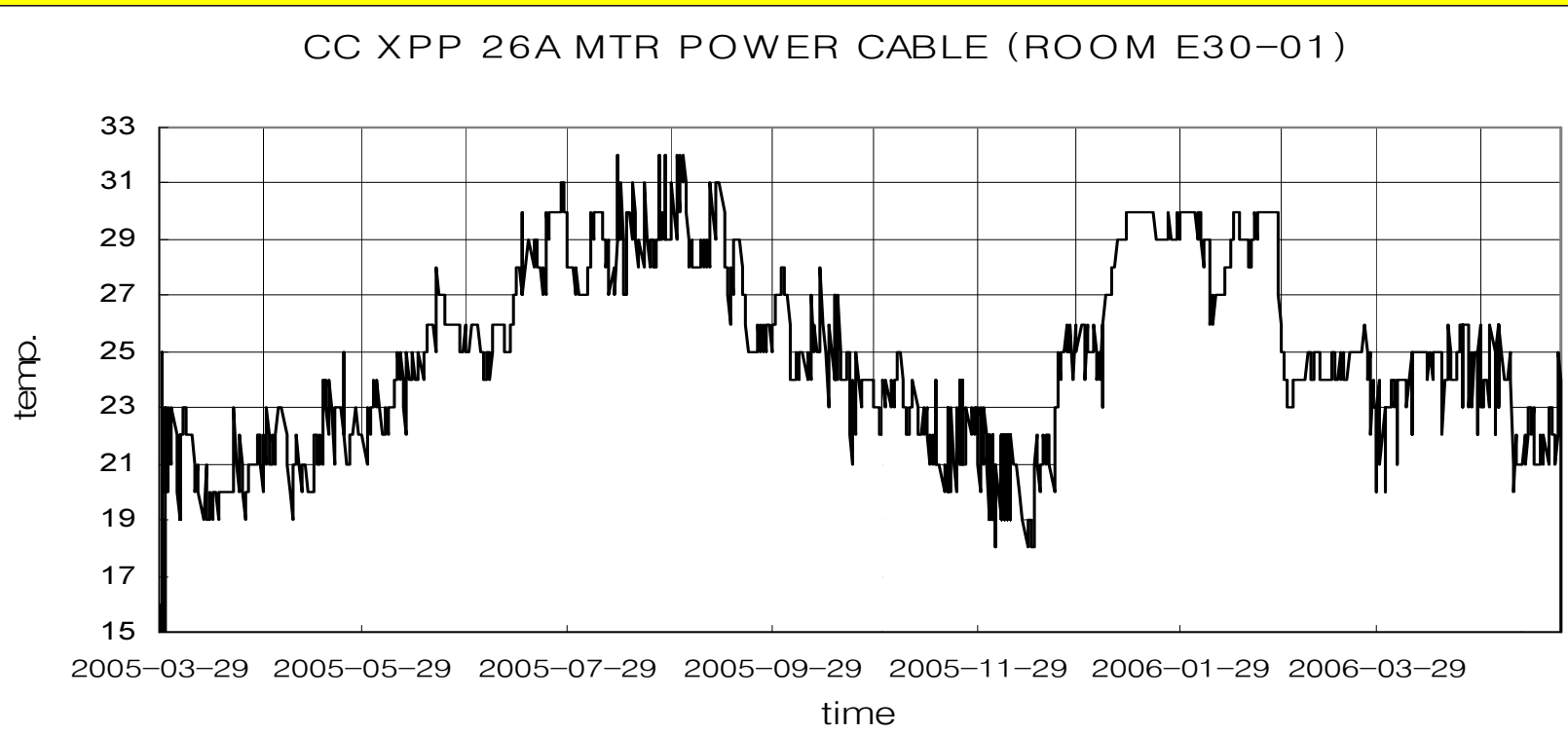
- Not established plant specific EQ program: 10CFR50.49
  - for there were no rigorous requirements for EQ in 1977
- 1st PSR was confirmed
  - K1 can operate safely during the continued operation period.
- EQ test reports of K1 : 1/3 equipments qualified by WH.
  - TLAA II: Temperature data used in aging evaluation on plant design temperature data or on plant actual data collected from temperature monitors.
- Recently replaced equipments including 740 items subjected to IEEE323(FSAR 3.11 revised)

2.Environmental Qualification(2-1)

- **On-line EQ condition monitoring**
  - **FIG. 1. On-line temperature monitoring system for cables and motors**
  - **FIG. 2. Handhold PDAs for data communication**

2. Environmental Qualification(2-2)

- **On-line EQ condition monitoring**
  - **FIG. 3. One year record of on-line temperature monitoring system for cables**



2. EQ Methods(3-1)

- EQ by Analysis
  - through the similarity analysis : a material aging analysis
    - 240 items including BA#.2 tank recirculation control valve IP
- Type test
    - 764 items including RCDT pump discharge outside containment isolation valve limit switch
- Operating Experience
    - Partial type tests on vital components of the equipment under qualification are provided in support of this method
- Combined EQ
  - Analysis + Partial Type test
    - 24 items including electrical actuators and MOV motors

2. EQ Methods(3-2)

- **Replacement with qualified equipment**
  - 740 items including Feed water HDR to SG A isolation valve actuator
- **Qualification of replaced equipment located in Harsh➔ Mild zone**
  - **11 items including 120V vital instrument panel 18A**
- qualification maintenance procedure
  - to analyze whether the failure of equipment affect initial qualification.

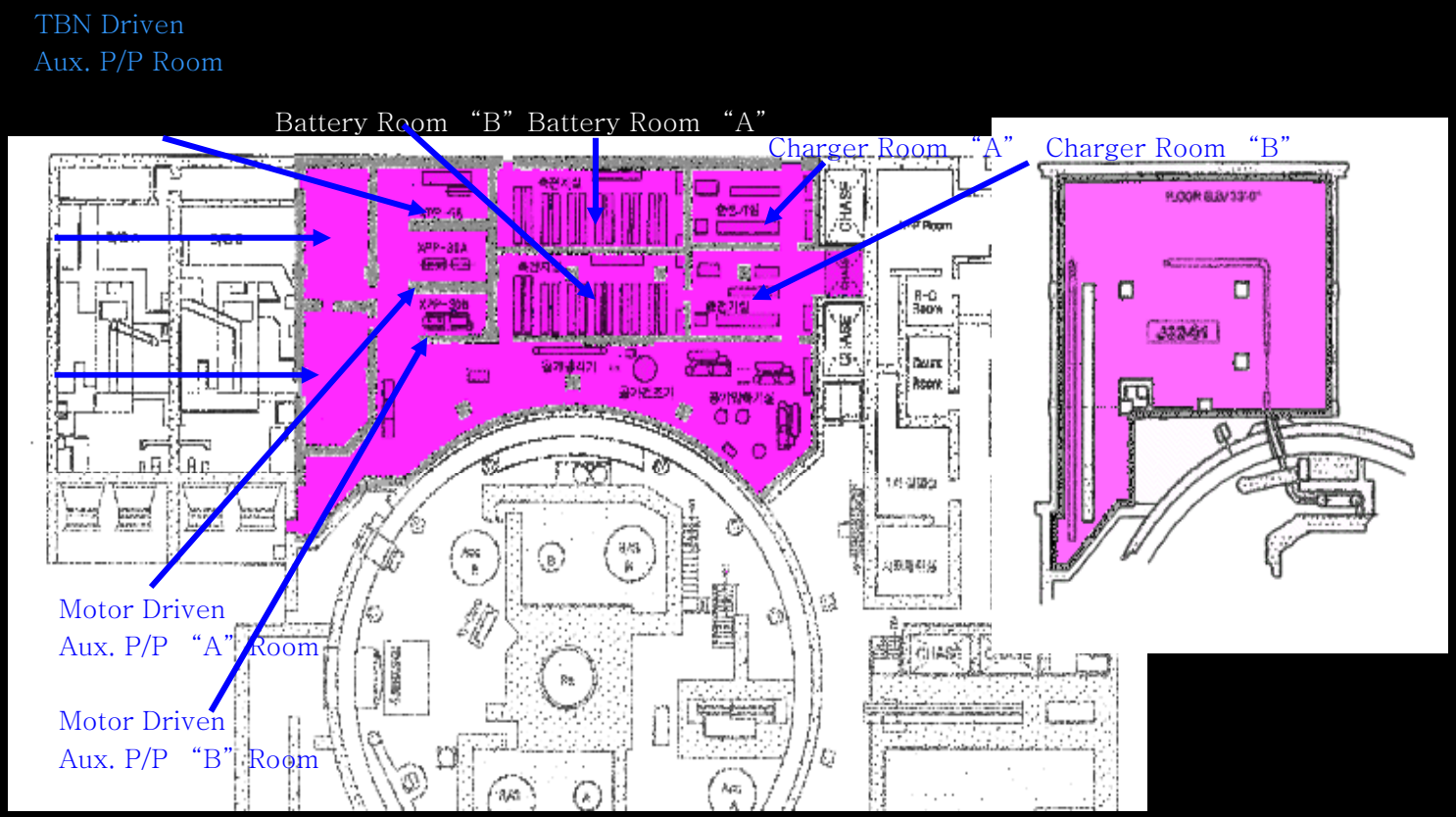
Table 1. Kori unit 1 maintenance procedures for continued operation (Examples)

Type	Title of work	Status of confirmation
Implementation of EQ	Replacement of electrical cables against non-compliance EQ requirements	Finished.
Improvement AMP for electrical and I &C system	Replacement of large motors	Finished.
Interconnection with PSA	Replacement of Class 1E Battery banks	Finished.
Improvement/Modification for heat exchanger and cooler	Replacement of 4.16kV Switch Gears (Non-1E)	Finished

2. EQ Methods(4): Replacement

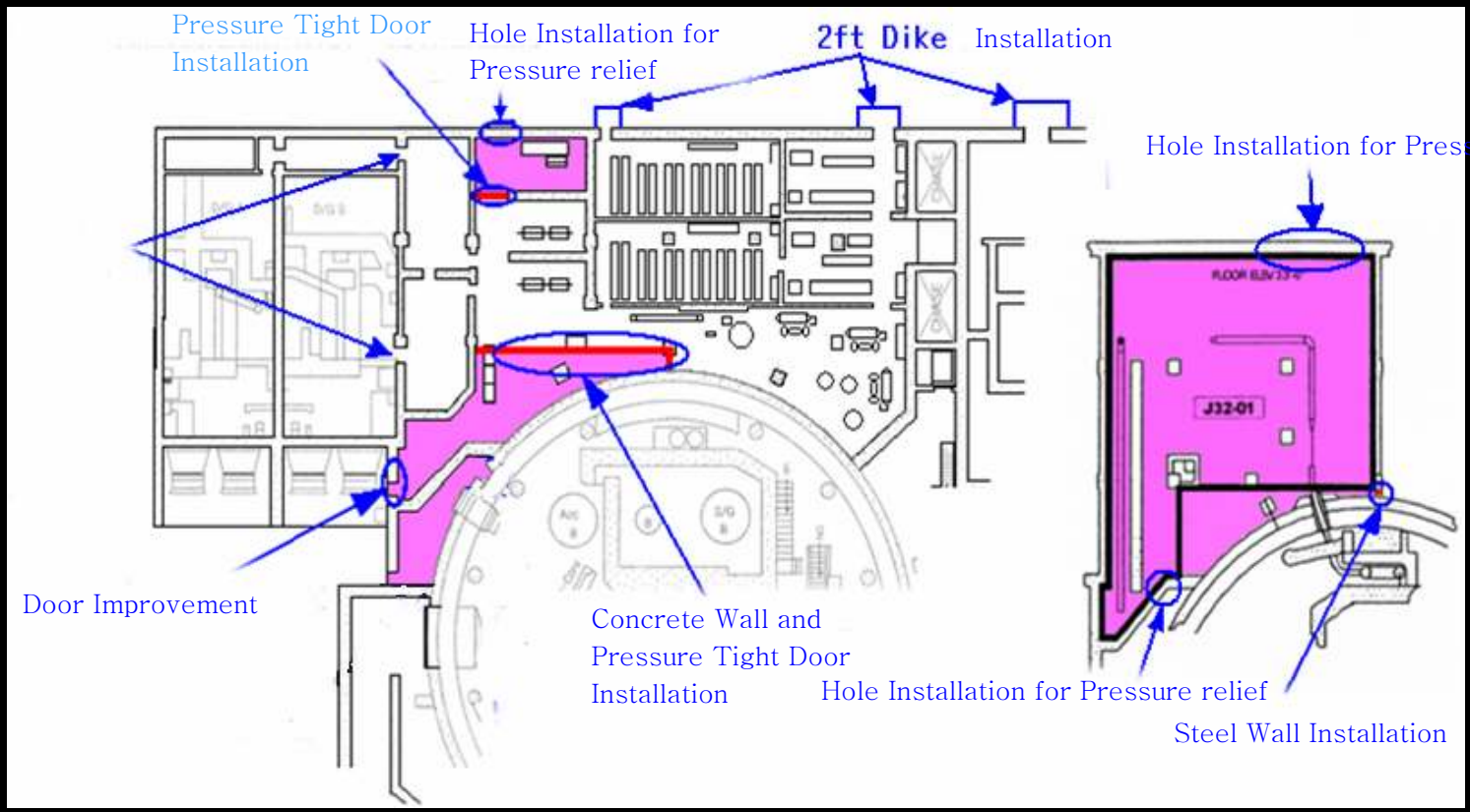
- Replacements of Class 1E batteries
  - Old Pb-Sb Battery(1200Ah) ➔ Pb-Ca Battery(1704Ah)

2. EQ Methods(5)



Harsh Zone (Before Improvement)

2. EQ Methods(5)



Harsh/Mild Zone (After Improvement)

3. TLAA and EQ Status [as 12 Oct 2007]

		TLAA(1)	TLAA(2)	TLAA(2)	SUM
1	E_ACT	40	12	14	66
2	E_MOTOR	0	12	6	18
3	E_MOV	10	12	14	66
4	E_PNL	0	11	0	11
5	E_SPLC	0	6	4	10
6	EPA	48	0	0	48
7	E_TMBLK	0	6	59	65
8	I_CNVRT	0	9	0	9
9	I_SEAL	56	4	150	210
10	I_LKDCTR	0	4	0	4
11	I_JNBC	22	4	0	26
12	I_LMSW	38	12	94	144
13	I_ELEM	9	40	46	95
14	AIR_SOL	52	0	26	78
15	I_SPLC	4	15	405	424
16	I_SOL	15	0	0	15
17	I_TMBLK	0	4	72	76
18	I_TRSMTR	0	57	4	61
SUM		324	208	894	1,426

4. Interim result of COI

- Flame retardant coatings not used as fire barriers for cables
  - Cable trays before/ after cable coating in the same places
  - Material: fire proof cable coating system, PYRO-SAFE FLAMMOTECT-A

4. Interim result of COI

- One hour fire barrier: Not finished on the flexible conduit

4. Interim result of COI(1)

- The issues solved are as follows
  - Evaluation of irradiated cables such as PVC/ EPR cables / Replacement of Class 1E PVC Cables used in the containment building with EPR cables(4,070m:171 circuit)
  - Improvement of reliability program for EDG
  - AMP Clarification of electric connectors and for Non-1E/ Class 1E cables and coaxial cables of Nuclear Instrumentation and Radiation Monitoring System (NIS & RMS)

4. Interim result of COI(2-1)

- An important review of replacement or new installation of electrical equipments such as,
  - Digital redundant protective relay system(2/3 trip logic for primary / backup system)
  - New SF6 gas Generator circuit breaker/ Class 1E Battery and Inverters/ BOP process control system
  - Flame-retardant coatings not used as fire barriers for cables(based on RG 1.189, 1.8.2 & 4.1.3.2)[10]
- Particular issues not covered by AMP, but implemented for safety improvement is
  - One time inspection: bus duct and fuse holders of 3-phase 260V CRDM power source

4. Interim result of COI(2-2)

- One time inspection: bus duct and fuse holders of 3-phase 260V CRDM power source

4. Interim result of COI(3)

- ***OVERALL SCHEDULE FOR COI + PSI***

Title of Inspection	Items to cover	Schedule 2007
IAEA Peer Review	Review of Submitted Documents for CO and Onsite walk-through inspection.	23 July ~ 3 Aug.
The 1st ~ 4th On-site Team inspection(COI)	1) scoping and screening items 2) walk-down of electric systems, 3) reviewing the onsite procedure of AMP	1) 22 Jan. ~ 26 Jan. 2)14 May ~ 18 May 3) 6 Aug. ~ 10 Aug. 4) 3 Sept. ~ 7 Sept
Onsite inspection for Modification for CO+PSI	4) performance commissioning test for new/ replaced electric equipments 5) Periodic Safety Inspection : e.g. Generator Circuit Breaker/ Fire Protection/ EDG/ Follow-up Action for EQ	(until Dec. 2007)

Thanks for your attention